

SEQUENCE LISTING

<110> SUGIURA, Takeyuki

<120> TETRAHYDROFOLATE SYNTHETASE GENE

<130> Q94181

<140> US 10/573,969

<141> 2006-03-30

<150> PCT/JP2004/014812

<151> 2004-09-30

<150> JP 2003-341245

<151> 2003-09-30

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<170> PatentIn version 3.1

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cag ccc ccg ggc cct ccg cgc cgc ctc cgt gtg ccc tgt cgc gct agc Gln Pro Pro Gly Pro Pro Arg Arg Leu Arg Val Pro Cys Arg Ala Ser 20 25 30	96
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agc ggc ggc gga ggc ggc ggt ggc cgg gag ggc ctg ctt gga Ser Gly Gly Gly Gly Gly Gly Arg Glu Gly Leu Leu Gly 35 40 45	144
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cag cgg ccg ccg cag gat ggc cag gcc cgg agc agc tgc agc ccc ggc Gln Arg Arg Pro Gln Asp Gly Gln Ala Arg Ser Ser Cys Ser Pro Gly 50 55 60	192
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ggc cga acg ccc gcg gcg cgg gac tcc atc gtc aga gaa gtc att cag Gly Arg Thr Pro Ala Ala Arg Asp Ser Ile Val Arg Glu Val Ile Gln 65 70 75 80	240
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aat tca aaa gaa gtt cta agt tta ttg caa gaa aaa aac cct gcc ttc Asn Ser Lys Glu Val Leu Ser Leu Leu Gln Glu Lys Asn Pro Ala Phe 85 90 95	288
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aag ccg gtt ctt gca att atc cag gca ggt gac gac aac ttg atg cag	336
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(1/10)

Lys Pro Val Leu Ala Ile Ile Gln Ala Gly Asp Asp Asn Leu Met Gln			
100	105	110	
gaa atc aac cag aat ttg gct gag gag gct ggt ctg aac atc act cac			384
Glu Ile Asn Gln Asn Leu Ala Glu Glu Ala Gly Leu Asn Ile Thr His			
115	120	125	
att tgc ctc cct cca gat agc agt gaa gcc gag att ata gat gaa atc			432
Ile Cys Leu Pro Pro Asp Ser Ser Glu Ala Glu Ile Ile Asp Glu Ile			
130	135	140	
tta aag atc aat gaa gat acc aga gta cat ggc ctt gcc ctt cag atc			480
Leu Lys Ile Asn Glu Asp Thr Arg Val His Gly Leu Ala Leu Gln Ile			
145	150	155	160
tct gag aac ttg ttt agc aac aaa gtc ctc aat gcc ttg aaa cca gaa			528
Ser Glu Asn Leu Phe Ser Asn Lys Val Leu Asn Ala Leu Lys Pro Glu			
165	170	175	
aaa gat gtg gat gga gta aca gac ata aac ctg ggg aag ctg gtg cga			576
Lys Asp Val Asp Gly Val Thr Asp Ile Asn Leu Gly Lys Leu Val Arg			
180	185	190	
ggg gat gcc cat gaa tgt ttt gtt tca cct gtt gcc aaa gct gta att			624
Gly Asp Ala His Glu Cys Phe Val Ser Pro Val Ala Lys Ala Val Ile			
195	200	205	
gaa ctt ctt gaa aaa tca ggt gtc aac cta gat gga aag aag att ttg			672
Glu Leu Leu Glu Lys Ser Gly Val Asn Leu Asp Gly Lys Lys Ile Leu			
210	215	220	
gta gtg ggg gcc cat ggg tct ttg gaa gct gct cta caa tgc ctg ttc			720
Val Val Gly Ala His Gly Ser Leu Glu Ala Ala Leu Gln Cys Leu Phe			
225	230	235	240
cag aga aaa ggg tcc atg aca atg agc atc cag tgg aaa aca cgc cag			768
Gln Arg Lys Gly Ser Met Thr Met Ser Ile Gln Trp Lys Thr Arg Gln			
245	250	255	
ctt caa agc aag ctt cac gag gct gac att gtg gtc cta ggc tca cct			816
Leu Gln Ser Lys Leu His Glu Ala Asp Ile Val Val Leu Gly Ser Pro			
260	265	270	
aag cca gaa gag att ccc ctt act tgg ata caa cca gga act act gtt			864
Lys Pro Glu Glu Ile Pro Leu Thr Trp Ile Gln Pro Gly Thr Thr Val			
275	280	285	
ctc aac tgc tcc cat gac ttc ctg tca ggg aag gtt ggg tgt ggc tct			912
Leu Asn Cys Ser His Asp Phe Leu Ser Gly Lys Val Gly Cys Gly Ser			
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cca aga ata cat ttt ggt gga ctc att gag gaa gat gat gtg att ctc			960
Pro Arg Ile His Phe Gly Gly Leu Ile Glu Glu Asp Asp Val Ile Leu			
305	310	315	320
ctt gct gca gct ctg cga att cag aac atg gtc agt agt gga agg aga			1008
Leu Ala Ala Ala Leu Arg Ile Gln Asn Met Val Ser Ser Gly Arg Arg			
325	330	335	
tgg ctt cgt gaa cag cag cac agg cgg tgg aga ctt cac tgc ttg aaa			1056

Trp	Leu	Arg	Glu	Gln	Gln	His	Arg	Arg	Trp	Arg	Leu	His	Cys	Leu	Lys	
340							345						350			
ctt	cag	cct	ctc	tcc	cct	gtg	cca	agt	gac	att	gag	att	tca	aga	gga	1104
Leu	Gln	Pro	Leu	Ser	Pro	Val	Pro	Ser	Asp	Ile	Glu	Ile	Ser	Arg	Gly	
355							360						365			
caa	act	cca	aaa	gct	gtg	gat	gtc	ctt	gcc	aag	gag	att	gga	ttg	ctt	1152
Gln	Thr	Pro	Lys	Ala	Val	Asp	Val	Leu	Ala	Lys	Glu	Ile	Gly	Leu	Leu	
370							375						380			
gca	gat	gaa	att	gaa	atc	tat	ggc	aaa	agc	aaa	gcc	aaa	gta	cgt	ttg	1200
Ala	Asp	Glu	Ile	Glu	Ile	Tyr	Gly	Lys	Ser	Lys	Ala	Lys	Val	Arg	Leu	
385							390						395			400
tcc	gtg	cta	gaa	agg	tta	aag	gat	caa	gca	gat	gga	aaa	tac	gtc	tta	1248
Ser	Val	Leu	Glu	Arg	Leu	Lys	Asp	Gln	Ala	Asp	Gly	Lys	Tyr	Val	Leu	
405							410						415			
gtt	gct	ggg	atc	aca	ccc	acc	cct	ctt	gga	gaa	ggg	aag	agc	aca	gtc	1296
Val	Ala	Gly	Ile	Thr	Pro	Thr	Pro	Leu	Gly	Glu	Gly	Lys	Ser	Thr	Val	
420							425						430			
acc	atc	ggg	ctt	gtg	cag	gct	ctg	acc	gca	cac	ctg	aat	gtc	aac	tcc	1344
Thr	Ile	Gly	Leu	Val	Gln	Ala	Leu	Thr	Ala	His	Leu	Asn	Val	Asn	Ser	
435							440						445			
ttt	gcc	tgc	ttg	agg	cag	cct	tcc	caa	gga	ccg	acg	ttt	gga	gtg	aaa	1392
Phe	Ala	Cys	Leu	Arg	Gln	Pro	Ser	Gln	Gly	Pro	Thr	Phe	Gly	Val	Lys	
450							455						460			
gga	gga	gcc	gcf	ggt	ggt	gga	tat	gcc	cag	gtc	atc	ccc	atg	gag	gag	1440
Gly	Gly	Ala	Ala	Gly	Gly	Gly	Tyr	Ala	Gln	Val	Ile	Pro	Met	Glu	Glu	
465							470						475			480
ttc	aac	ctt	cac	ttg	act	gga	gac	atc	cac	gcc	atc	acc	gct	gcc	aat	1488
Phe	Asn	Leu	His	Leu	Thr	Gly	Asp	Ile	His	Ala	Ile	Thr	Ala	Ala	Asn	
485							490						495			
aac	ttg	ctg	gct	gcc	gcc	atc	gac	acg	agg	att	ctt	cat	gaa	aac	acg	1536
Asn	Leu	Leu	Ala	Ala	Ala	Ile	Asp	Thr	Arg	Ile	Leu	His	Glu	Asn	Thr	
500							505						510			
caa	aca	gat	aag	gct	ctg	tat	aat	cgg	ctg	gtt	cct	tta	gtg	aat	ggt	1584
Gln	Thr	Asp	Lys	Ala	Leu	Tyr	Asn	Arg	Leu	Val	Pro	Leu	Val	Asn	Gly	
515							520						525			
gtc	aga	gaa	ttt	tca	gaa	att	cag	ctt	gct	cg	cta	aaa	aaa	ctg	gga	1632
Val	Arg	Glu	Phe	Ser	Glu	Ile	Gln	Leu	Ala	Arg	Leu	Lys	Lys	Leu	Gly	
530							535						540			
ata	aat	aag	act	gat	ccg	agc	aca	ctg	aca	gaa	gag	gaa	gtg	agt	aaa	1680
Ile	Asn	Lys	Thr	Asp	Pro	Ser	Thr	Leu	Thr	Glu	Glu	Glu	Val	Ser	Lys	
545							550						555			560
ttt	gcc	cgt	ctc	gac	atc	gac	cca	tct	acc	atc	acg	tgg	cag	aga	gtc	1728
Phe	Ala	Arg	Leu	Asp	Ile	Asp	Pro	Ser	Thr	Ile	Thr	Trp	Gln	Arg	Val	
565							570						575			
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Leu Asp Thr Asn Asp Arg Phe Leu Arg Lys Ile Thr Ile Gly Gln Gly			
580	585	590	
aac aca gag aag ggc cat tac cgg cag gcg cag ttt gac atc gca gtg		1824	
Asn Thr Glu Lys Gly His Tyr Arg Gln Ala Gln Phe Asp Ile Ala Val			
595	600	605	
gcc agc gag atc atg gcg gtg ctg gcc ctg acg gac agc ctc gca gac		1872	
Ala Ser Glu Ile Met Ala Val Leu Ala Leu Thr Asp Ser Leu Ala Asp			
610	615	620	
atg aag gca cgg ctg gga agg atg gtg gtg gcc agt gac aaa agc ggg		1920	
Met Lys Ala Arg Leu Gly Arg Met Val Val Ala Ser Asp Lys Ser Gly			
625	630	635	640
cag cct gtg aca gca gat gat ttg ggg gtg aca ggt gct ttg aca gtt		1968	
Gln Pro Val Thr Ala Asp Asp Leu Gly Val Thr Gly Ala Leu Thr Val			
645	650	655	
ttg atg aaa gat gca ata aaa cca aac ctg atg cag acc ctg gaa ggg		2016	
Leu Met Lys Asp Ala Ile Lys Pro Asn Leu Met Gln Thr Leu Glu Gly			
660	665	670	
aca cct gtg ttc gtg cat gcg ggc cct ttt gct aac att gct cac ggc		2064	
Thr Pro Val Phe Val His Ala Gly Pro Phe Ala Asn Ile Ala His Gly			
675	680	685	
aac tct tca gtg ttg gct gat aaa att gcc ctg aaa ctg gtt ggt gaa		2112	
Asn Ser Ser Val Leu Ala Asp Lys Ile Ala Leu Lys Leu Val Gly Glu			
690	695	700	
gaa gga ttt gta gtg acc gaa gct ggc ttt ggt gct gac atc gga atg		2160	
Glu Gly Phe Val Val Thr Glu Ala Gly Phe Gly Ala Asp Ile Gly Met			
705	710	715	720
gag aaa ttc ttc aac atc aag tgc cga gct tcc ggc ttg gtg ccc aac		2208	
Glu Lys Phe Phe Asn Ile Lys Cys Arg Ala Ser Gly Leu Val Pro Asn			
725	730	735	
gtg gtt gtg tta gtg gca acg gtg cga gct ctg aag atg cat gga ggc		2256	
Val Val Val Leu Val Ala Thr Val Arg Ala Leu Lys Met His Gly Gly			
740	745	750	
ggg cca agt gta acg gct ggt gtt cct ctt aag aaa gaa tat aca gag		2304	
Gly Pro Ser Val Thr Ala Gly Val Pro Leu Lys Lys Glu Tyr Thr Glu			
755	760	765	
gag aac atc cag ctg gtg gca gac ggc tgc tgt aac ctc cag aag caa		2352	
Glu Asn Ile Gln Leu Val Ala Asp Gly Cys Cys Asn Leu Gln Lys Gln			
770	775	780	
att cag atc act cag ctc ttt ggg gtt ccc gtt gtg gtg gct ctg aat		2400	
Ile Gln Ile Thr Gln Leu Phe Gly Val Pro Val Val Ala Leu Asn			
785	790	795	800
gtc ttc aag acc gac acc cgc gct gag att gac ttg gtg tgt gag ctt		2448	
Val Phe Lys Thr Asp Thr Arg Ala Glu Ile Asp Leu Val Cys Glu Leu			
805	810	815	
gca aag cgg gct ggt gcc ttt gat gca gtc ccc tgc tat cac tgg tcg		2496	

Ala Lys Arg Ala Gly Ala Phe Asp Ala Val Pro Cys Tyr His Trp Ser			
820	825	830	
gtt ggt gga aaa gga tcg gtg gac ttg gct cgg gct gtg aga gag gct		2544	
Val Gly Gly Lys Gly Ser Val Asp Leu Ala Arg Ala Val Arg Glu Ala			
835	840	845	
gcg agt aaa aga agc cga ttc cag ttc ctg tat gat gtt cag gtt cca		2592	
Ala Ser Lys Arg Ser Arg Phe Gln Phe Leu Tyr Asp Val Gln Val Pro			
850	855	860	
att gtg gac aag ata agg acc att gct cag gct gtc tat gga gcc aaa		2640	
Ile Val Asp Lys Ile Arg Thr Ile Ala Gln Ala Val Tyr Gly Ala Lys			
865	870	875	880
gat att gaa ctc tct cct gag gca caa gcc aaa ata gat cgt tac act		2688	
Asp Ile Glu Leu Ser Pro Glu Ala Gln Ala Lys Ile Asp Arg Tyr Thr			
885	890	895	
caa cag ggt ttt gga aat ttg ccc atc tgc atg gca aag acc cac ctt		2736	
Gln Gln Gly Phe Gly Asn Leu Pro Ile Cys Met Ala Lys Thr His Leu			
900	905	910	
tct cta tct cac caa cct gac aaa aaa ggt gtg cca agg gac ttc atc		2784	
Ser Leu Ser His Gln Pro Asp Lys Lys Gly Val Pro Arg Asp Phe Ile			
915	920	925	
tta cct atc agt gac gtc cggt gcc agc ata ggc gct ggg ttc att tac		2832	
Leu Pro Ile Ser Asp Val Arg Ala Ser Ile Gly Ala Gly Phe Ile Tyr			
930	935	940	
cct ttg gtc gga acg atg agc acc atg cca gga ctg ccc acc cgg ccc		2880	
Pro Leu Val Gly Thr Met Ser Thr Met Pro Gly Leu Pro Thr Arg Pro			
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tgc ttt tat gac ata gat ctt gat acc gaa aca gaa caa gtt aaa ggc		2928	
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Leu Phe			

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Ser Gly Gly Gly Gly Gly Gly Arg Glu Gly Leu Leu Gly

(5/10)

35

40

45

Gln Arg Arg Pro Gln Asp Gly Gln Ala Arg Ser Ser Cys Ser Pro Gly
50 55 60

Gly Arg Thr Pro Ala Ala Arg Asp Ser Ile Val Arg Glu Val Ile Gln
65 70 75 80

Asn Ser Lys Glu Val Leu Ser Leu Leu Gln Glu Lys Asn Pro Ala Phe
85 90 95

Lys Pro Val Leu Ala Ile Ile Gln Ala Gly Asp Asp Asn Leu Met Gln
100 105 110

Glu Ile Asn Gln Asn Leu Ala Glu Glu Ala Gly Leu Asn Ile Thr His
115 120 125

Ile Cys Leu Pro Pro Asp Ser Ser Glu Ala Glu Ile Ile Asp Glu Ile
130 135 140

Leu Lys Ile Asn Glu Asp Thr Arg Val His Gly Leu Ala Leu Gln Ile
145 150 155 160

Ser Glu Asn Leu Phe Ser Asn Lys Val Leu Asn Ala Leu Lys Pro Glu
165 170 175

Lys Asp Val Asp Gly Val Thr Asp Ile Asn Leu Gly Lys Leu Val Arg
180 185 190

Gly Asp Ala His Glu Cys Phe Val Ser Pro Val Ala Lys Ala Val Ile
195 200 205

Glu Leu Leu Glu Lys Ser Gly Val Asn Leu Asp Gly Lys Lys Ile Leu
210 215 220

Val Val Gly Ala His Gly Ser Leu Glu Ala Ala Leu Gln Cys Leu Phe
225 230 235 240

Gln Arg Lys Gly Ser Met Thr Met Ser Ile Gln Trp Lys Thr Arg Gln
245 250 255

Leu Gln Ser Lys Leu His Glu Ala Asp Ile Val Val Leu Gly Ser Pro
260 265 270

Lys Pro Glu Glu Ile Pro Leu Thr Trp Ile Gln Pro Gly Thr Thr Val
(6/10)

275

280

285

Leu Asn Cys Ser His Asp Phe Leu Ser Gly Lys Val Gly Cys Gly Ser
290 295 300

Pro Arg Ile His Phe Gly Gly Leu Ile Glu Glu Asp Asp Val Ile Leu
305 310 315 320

Leu Ala Ala Ala Leu Arg Ile Gln Asn Met Val Ser Ser Gly Arg Arg
325 330 335

Trp Leu Arg Glu Gln Gln His Arg Arg Trp Arg Leu His Cys Leu Lys
340 345 350

Leu Gln Pro Leu Ser Pro Val Pro Ser Asp Ile Glu Ile Ser Arg Gly
355 360 365

Gln Thr Pro Lys Ala Val Asp Val Leu Ala Lys Glu Ile Gly Leu Leu
370 375 380

Ala Asp Glu Ile Glu Ile Tyr Gly Lys Ser Lys Ala Lys Val Arg Leu
385 390 395 400

Ser Val Leu Glu Arg Leu Lys Asp Gln Ala Asp Gly Lys Tyr Val Leu
405 410 415

Val Ala Gly Ile Thr Pro Thr Pro Leu Gly Glu Gly Lys Ser Thr Val
420 425 430

Thr Ile Gly Leu Val Gln Ala Leu Thr Ala His Leu Asn Val Asn Ser
435 440 445

Phe Ala Cys Leu Arg Gln Pro Ser Gln Gly Pro Thr Phe Gly Val Lys
450 455 460

Gly Gly Ala Ala Gly Gly Gly Tyr Ala Gln Val Ile Pro Met Glu Glu
465 470 475 480

Phe Asn Leu His Leu Thr Gly Asp Ile His Ala Ile Thr Ala Ala Asn
485 490 495

Asn Leu Leu Ala Ala Ala Ile Asp Thr Arg Ile Leu His Glu Asn Thr
500 505 510

Gln Thr Asp Lys Ala Leu Tyr Asn Arg Leu Val Pro Leu Val Asn Gly
(7/10)

515

520

525

Val Arg Glu Phe Ser Glu Ile Gln Leu Ala Arg Leu Lys Lys Leu Gly
530 535 540

Ile Asn Lys Thr Asp Pro Ser Thr Leu Thr Glu Glu Glu Val Ser Lys
545 550 555 560

Phe Ala Arg Leu Asp Ile Asp Pro Ser Thr Ile Thr Trp Gln Arg Val
565 570 575

Leu Asp Thr Asn Asp Arg Phe Leu Arg Lys Ile Thr Ile Gly Gln Gly
580 585 590

Asn Thr Glu Lys Gly His Tyr Arg Gln Ala Gln Phe Asp Ile Ala Val
595 600 605

Ala Ser Glu Ile Met Ala Val Leu Ala Leu Thr Asp Ser Leu Ala Asp
610 615 620

Met Lys Ala Arg Leu Gly Arg Met Val Val Ala Ser Asp Lys Ser Gly
625 630 635 640

Gln Pro Val Thr Ala Asp Asp Leu Gly Val Thr Gly Ala Leu Thr Val
645 650 655

Leu Met Lys Asp Ala Ile Lys Pro Asn Leu Met Gln Thr Leu Glu Gly
660 665 670

Thr Pro Val Phe Val His Ala Gly Pro Phe Ala Asn Ile Ala His Gly
675 680 685

Asn Ser Ser Val Leu Ala Asp Lys Ile Ala Leu Lys Leu Val Gly Glu
690 695 700

Glu Gly Phe Val Val Thr Glu Ala Gly Phe Gly Ala Asp Ile Gly Met
705 710 715 720

Glu Lys Phe Phe Asn Ile Lys Cys Arg Ala Ser Gly Leu Val Pro Asn
725 730 735

Val Val Val Leu Val Ala Thr Val Arg Ala Leu Lys Met His Gly Gly
740 745 750

Gly Pro Ser Val Thr Ala Gly Val Pro Leu Lys Lys Glu Tyr Thr Glu
(8/10)

755

760

765

Glu Asn Ile Gln Leu Val Ala Asp Gly Cys Cys Asn Leu Gln Lys Gln
770 775 780

Ile Gln Ile Thr Gln Leu Phe Gly Val Pro Val Val Val Ala Leu Asn
785 790 795 800

Val Phe Lys Thr Asp Thr Arg Ala Glu Ile Asp Leu Val Cys Glu Leu
805 810 815

Ala Lys Arg Ala Gly Ala Phe Asp Ala Val Pro Cys Tyr His Trp Ser
820 825 830

Val Gly Gly Lys Gly Ser Val Asp Leu Ala Arg Ala Val Arg Glu Ala
835 840 845

Ala Ser Lys Arg Ser Arg Phe Gln Phe Leu Tyr Asp Val Gln Val Pro
850 855 860

Ile Val Asp Lys Ile Arg Thr Ile Ala Gln Ala Val Tyr Gly Ala Lys
865 870 875 880

Asp Ile Glu Leu Ser Pro Glu Ala Gln Ala Lys Ile Asp Arg Tyr Thr
885 890 895

Gln Gln Gly Phe Gly Asn Leu Pro Ile Cys Met Ala Lys Thr His Leu
900 905 910

Ser Leu Ser His Gln Pro Asp Lys Lys Gly Val Pro Arg Asp Phe Ile
915 920 925

Leu Pro Ile Ser Asp Val Arg Ala Ser Ile Gly Ala Gly Phe Ile Tyr
930 935 940

Pro Leu Val Gly Thr Met Ser Thr Met Pro Gly Leu Pro Thr Arg Pro
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Leu Phe

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